elements in the figures may be exaggerated relative to other elements, as well as conventional parts removed, to help to improve understanding of the various embodiments of the present invention.

DETAILED DESCRIPTION

The following terms are used in the present application:

As used herein, the term "toxin" refers to a poisonous substance produced by living cells, organisms, and/or artificial processes.

As used herein, the term "sample" refers to a substance and/or mixture of substances, and combinations thereof, to be analyzed with electrophoretic separations. In one aspect, the "sample" comprises toxins such that the presence and/or concentration of toxins may be detected.

As used herein, the term "electrophoretic separations" refers to the migration of charged molecules through a solution under the influence of an applied electric potential. In one aspect, the term "electrophoretic separations" refers to electrophoretic separations performed using gradient elution moving boundary electrophoresis.

As used herein, the term "signaling enzyme" refers to a biological molecule that is capable of catalyzing a chemical reaction. In one aspect, the "signaling enzyme" is sensitive to the presence of a toxin. In the context of a signaling enzyme, the term "sensitive to the presence of a toxin" refers to a signaling enzyme having biological activity which is affected by the presence of a toxin. In one aspect, "sensitive to the presence of a toxin" refers to a signaling enzyme having biological activity which is affected and/or changed by the presence of a toxin, wherein the toxin stimulates the activity of the signaling enzyme or inhibits the activity of the signaling enzyme.

As used herein, the term "activity" refers to a quantitative determination of the rate of enzymatic conversion of a substrate to a product.

As used herein, the term "substrate" refers to a molecule upon which a signaling enzyme can act. As used herein, the term "product" refers to a molecule that is formed by the signaling enzyme acting upon the substrate.

As used herein, the term "reaction medium" refers to a fluid comprising an electrophoretic buffer and/or a reaction buffer, and combinations thereof. In one particular aspect, the "reaction medium" comprises a reaction buffer, an enzyme, a substrate, and/or a sample, and combinations thereof.

As used herein, the term "run buffer" refers to a fluid comprising an electrophoretic buffer.

As used herein, the term "separation channel" refers to a channel wherein electrophoretic separation of the substrate, product, charged particulates, and/or charged analytes, and combinations thereof, occurs under the influence of an applied electric potential.

As used herein, the term "electric potential" refers to the electrostatic potential energy divided by the charge in a circuit expressed in volts. In the context of electrophoretic separations, the "electric potential" is imposed across and substantially along the length of the separation channel.

As used herein, the terms "variable bulk flow" and "bulk flow" are used interchangeably to refer to the combination of electroosmotic flow and controlled, variable pressure-driven flow that is varied over time during an electrophoretic separation. As used herein, the term "changing the bulk flow velocity" refers to altering the rate of a variable bulk flow, such that sequential separation of substrates, products, charged particulates and/or charged analytes, and combinations thereof, may be achieved.

As used herein, the term "sequentially detected and quantified" refers to the consecutive detection of the substrate, the product, the charged particulates, and/or the oppositely charged analytes, and combinations thereof, following differential migration of the substrate, the product, the charged particulates, and/or the oppositely charged analytes, and combinations thereof, through the separation channel.

As used herein, the terms "detect", "detection", and/or "detecting" are used interchangeably to refer to determining the presence and/or concentration of toxins and/or analytes, and combinations thereof.

In the context of determining the rate of conversion of the substrate to the product, the term "change in the rate of conversion" refers to an increase or a decrease in the activity of signaling enzyme.

As used herein, the term "control sample assay" refers to an enzymatic assay wherein a signaling enzyme is reacted with a substrate in a reaction medium, wherein the signaling enzyme converts the substrate to a product, and wherein the substrate and the product are detected by GEMBE in the absence of a toxin.

As used herein, the term "nerve agent" refers to a class of organophosphates that disrupt the mechanism by which nerves transfer messages by blocking acetylcholinesterase. As used herein, the term "pesticide" refers to a class of nerve agents that are used to kill pests. As used herein, the term "endotoxin" refers to a toxic molecules derived from bacteria which are released when the bacteria are lysed. As used herein, the terms "organophosphate" and "organophosphates" are used interchangeably to refer to phosphorous-containing organic molecules.

As used herein, the term "complex sample" refers to a substance containing charged particulates and/or oppositely charged analytes, and combinations thereof.

As used herein, the term "charged particulates" refers to particles of solid and/or liquid suspended in a gas or liquid possessing an electric charge. As used herein, the term "oppositely charged analytes" refers to molecules possessing an electric charge that is of an opposite sign of the charged particulate and/or charged particulates.

As used herein the terms "stimulant", "stimulate", "stimulated", and "stimulation" are used interchangeably to refer to the ability of a toxin to increase the activity of a signaling enzyme. As used herein, the terms "inhibitor", "inhibit", "inhibited", and "inhibition" are used interchangeably to refer to the ability of a toxin to decrease the activity of a signaling enzyme.

As used herein, the terms "fluidic" and "fluid" are used interchangeably to refer to a liquid and/or a gas, and combinations thereof.

As used herein, the terms "varying the bulk flow" and/or "controlling the variable bulk flow" are used interchangeably to refer to regulating the rate of a bulk flow, such that sequential separation of analytes may be achieved.

As used herein, the term "buffer reservoir" refers to a reservoir which contains a fluid.

As used herein, the term "pressure sensor" refers to a device for monitoring the pressure of the fluid in the buffer reservoir. More particularly, the term "pressure sensor" refers to a device for monitoring the pressure of a gas in the headspace of the buffer reservoir.

As used herein, the term "high pressure reservoir" refers to a reservoir which contains a fluid, wherein the reservoir has a higher than ambient pressure when the pumping device pumps a gas from the low pressure reservoir to the high pressure reservoir.

As used herein, the term "low pressure reservoir" refers to a reservoir which contains a fluid, wherein the reservoir has a lower than ambient pressure when the pumping device pumps a gas from the low pressure reservoir to the high pressure reservoir.

As used herein, the terms "selective fluid communication" and "selective fluidic communication" are used interchange-